OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **ROCK POND** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *generally stable, but variable*, in-lake chlorophyll-a trend. Chlorophyll concentrations were elevated this season, much like they were in 1998. June concentrations were above the NH mean reference line, indicating that rainy seasons promote increases in algal growth in Rock Pond due to flushing of nutrients from the watershed. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *stable* trend in lake transparency, although readings have declined the past three years. Transparency decreased this year most likely as the result of the increase in algal growth. Mean transparency in Rock Pond has remained above the average value for NH lakes for 14 years! The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters.

Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show an *improving* trend for in-lake phosphorus levels, which means concentrations are decreasing. Phosphorus concentrations were fairly consistent with last season's results, and remained low for Rock Pond. Both layers had mean phosphorus concentrations below the state median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- **Please note** in June this summer phosphorus levels were reported as less than 5 µg/L for the Outlet. The NHDES Laboratory Services adopted a new method of analyzing total phosphorus this year and the lowest value that can be recorded is 'less than 5 µg/L'. We would like to remind the association that a reading of 5 µg/L is considered low for New Hampshire's waters.

- Oxygen was depleted in the last two meters of the lake during August (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the sediments may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. The concentration in the hypolimnion during August did not reflect an internal source of phosphorus. This is due to the sampling depth being at 5 meters, which is above the depth at which oxygen is depleted. We recommend sampling at 6 meters in the future so that we can get a better idea of how much phosphorus is being released into the water column. Since an internal source of phosphorus to the lake is most likely present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.

- Phosphorus concentrations were the lowest ever seen in the Inlet this season (Table 8). This is the first time since 1997 that the Inlet has been tested, and the results are a marked improvement. The increased rainfall likely helped to flush the Inlet and also kept flow at sufficient levels to obtain clean samples. We hope to see these low concentrations again next season.

NOTES

- Monitor's Note (8/9/00): Above average rainfall.

USEFUL RESOURCES

Comprehensive Shoreland Protection Act, RSA 483-B, WD-BB-35, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

Wetlands: More Important Than You Think, NHDES Booklet, (603) 271-3503 or www.state.nh.us

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Vegetated Shoreline Buffers, video, North Country RC&D, (603) 527-2093

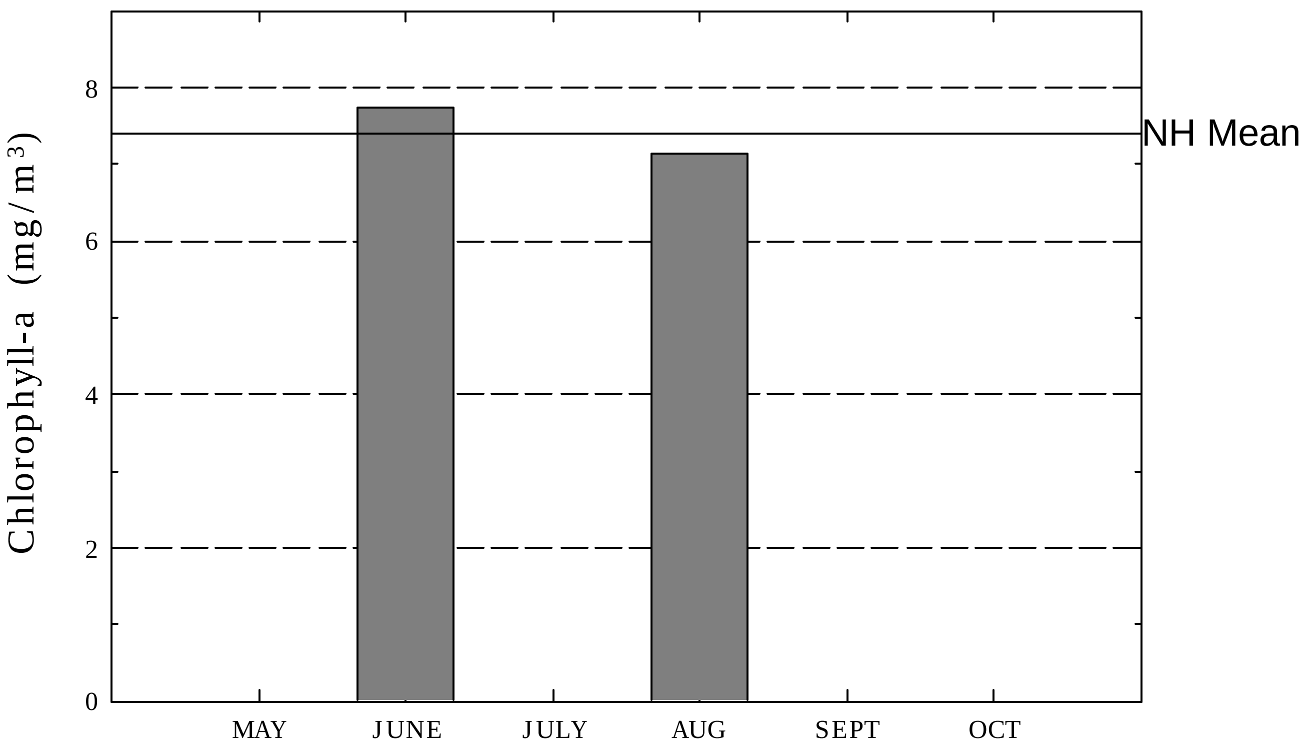
Diet for a Small Lake: A New Yorker's Guide to Lake Management. Federation of Lake Associations, Cazenovia, NY, 1990. (800) 796-FOLA, or www.nysfola.org

Through the Looking Glass: A Field Guide to Aquatic Plants. North American Lake Management Society, 1988. (608) 233-2836 or www.nalms.org

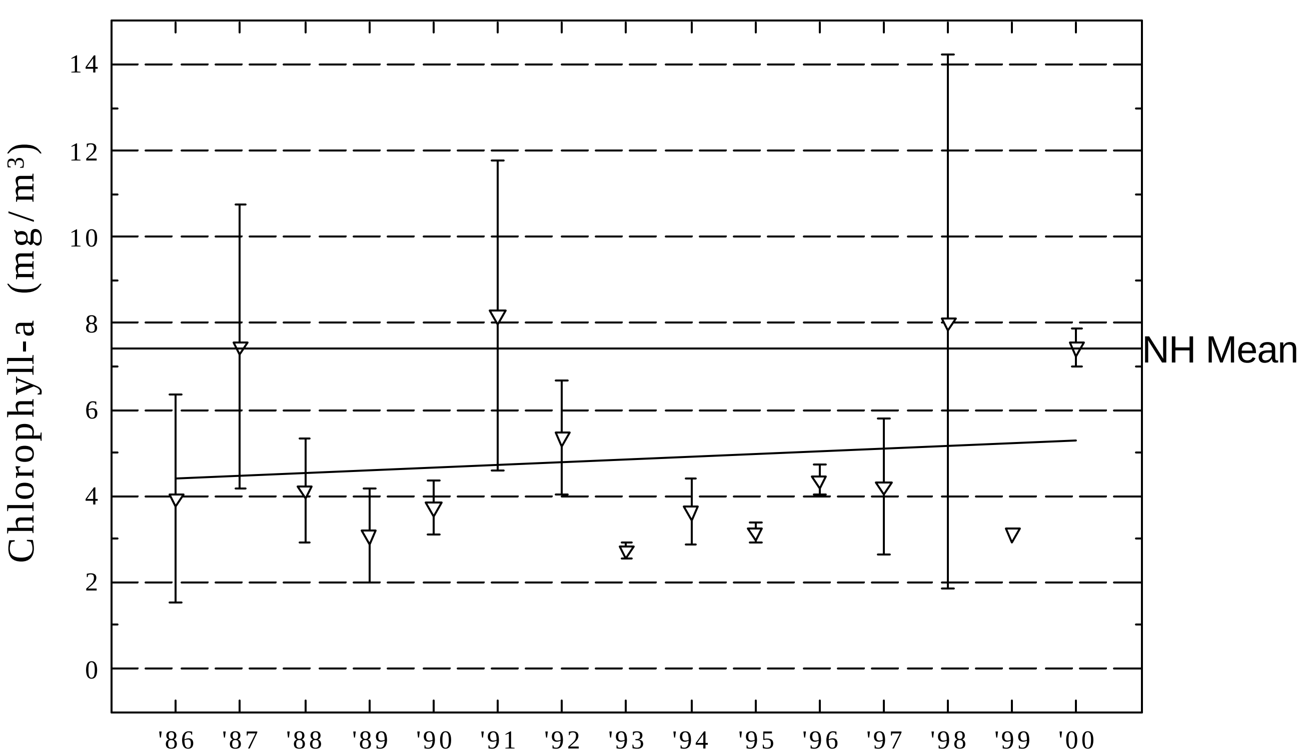
Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast. By Dennis Magee, Univ. of Massachusetts Press, 1981. (413) 545-0111, or www.umass.edu/umext/bookstore.html

Rock Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



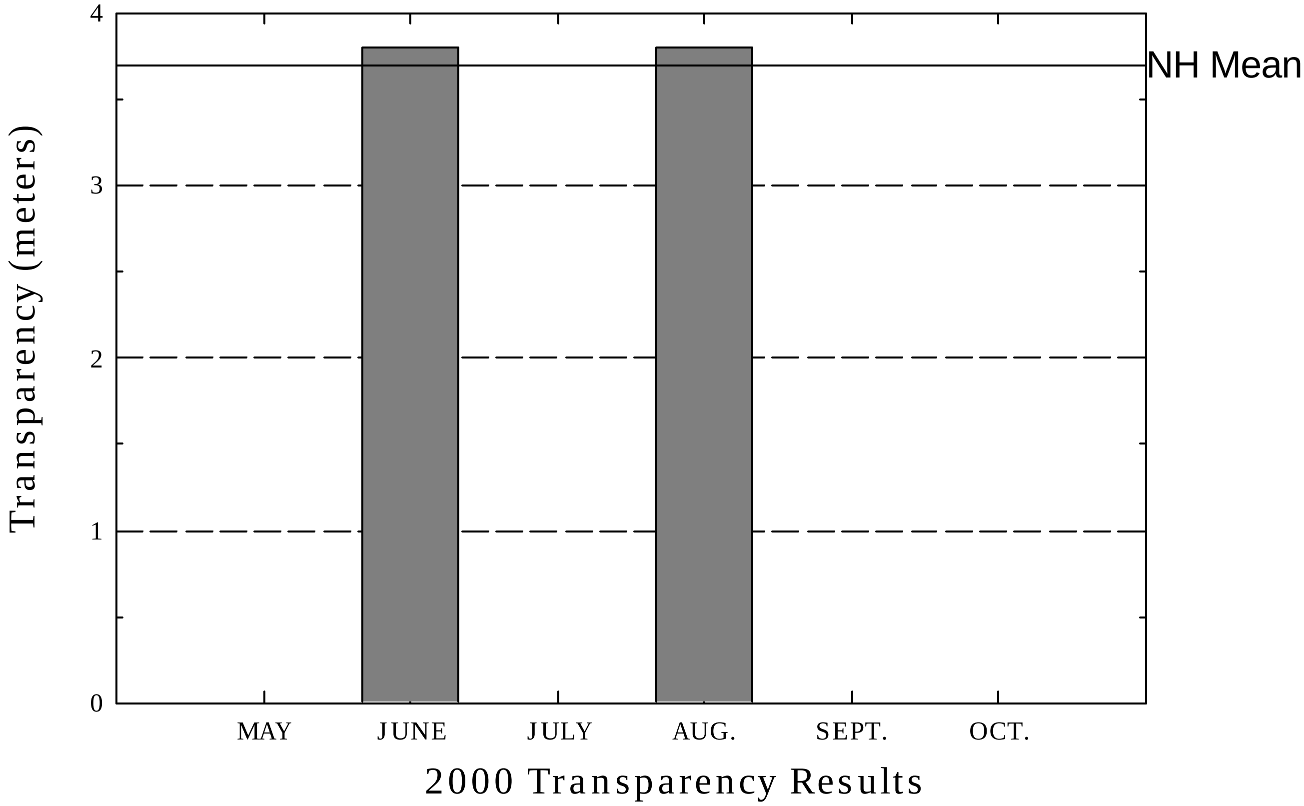
2000 Chlorophyll-a Results

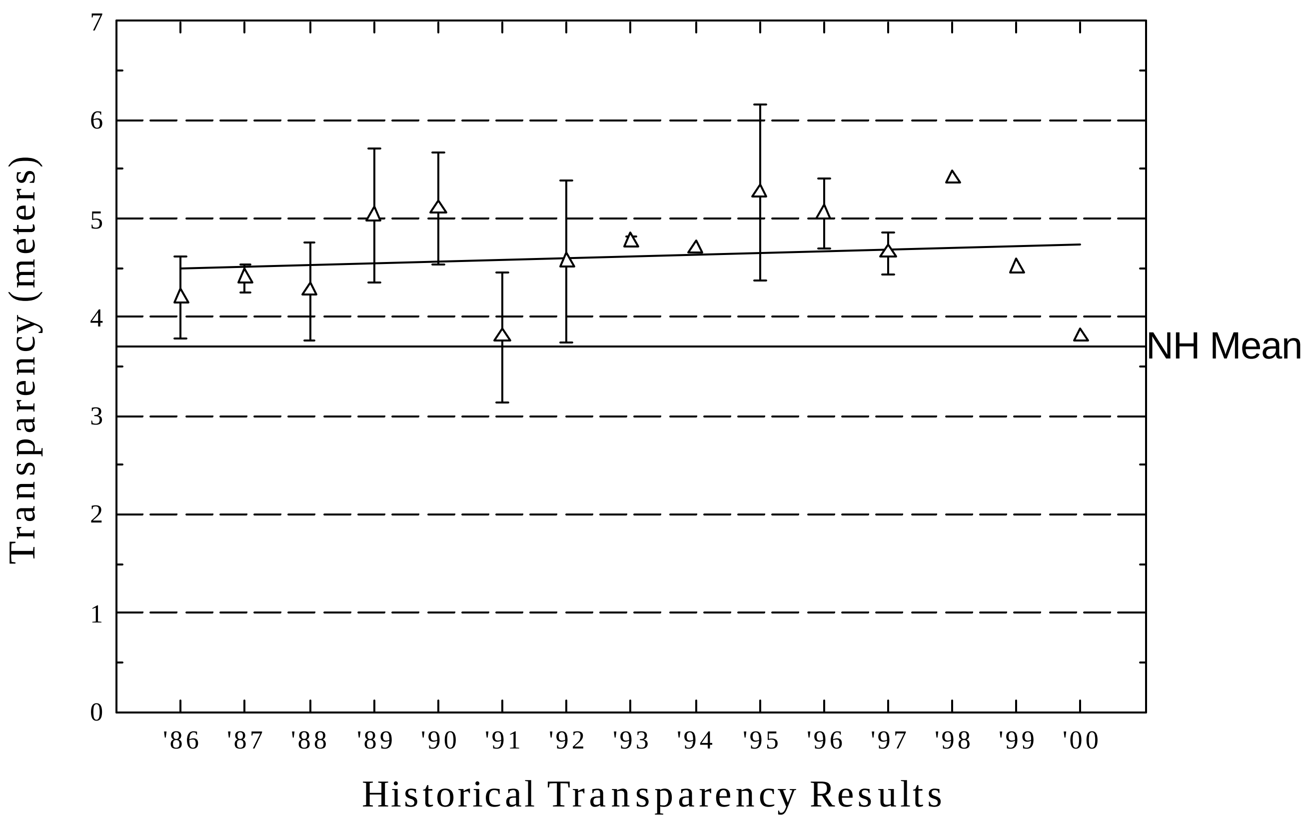


Historical Chlorophyll-a Results

Rock Pond

Figure 2. Monthly and Historical Transparency Results





Rock Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

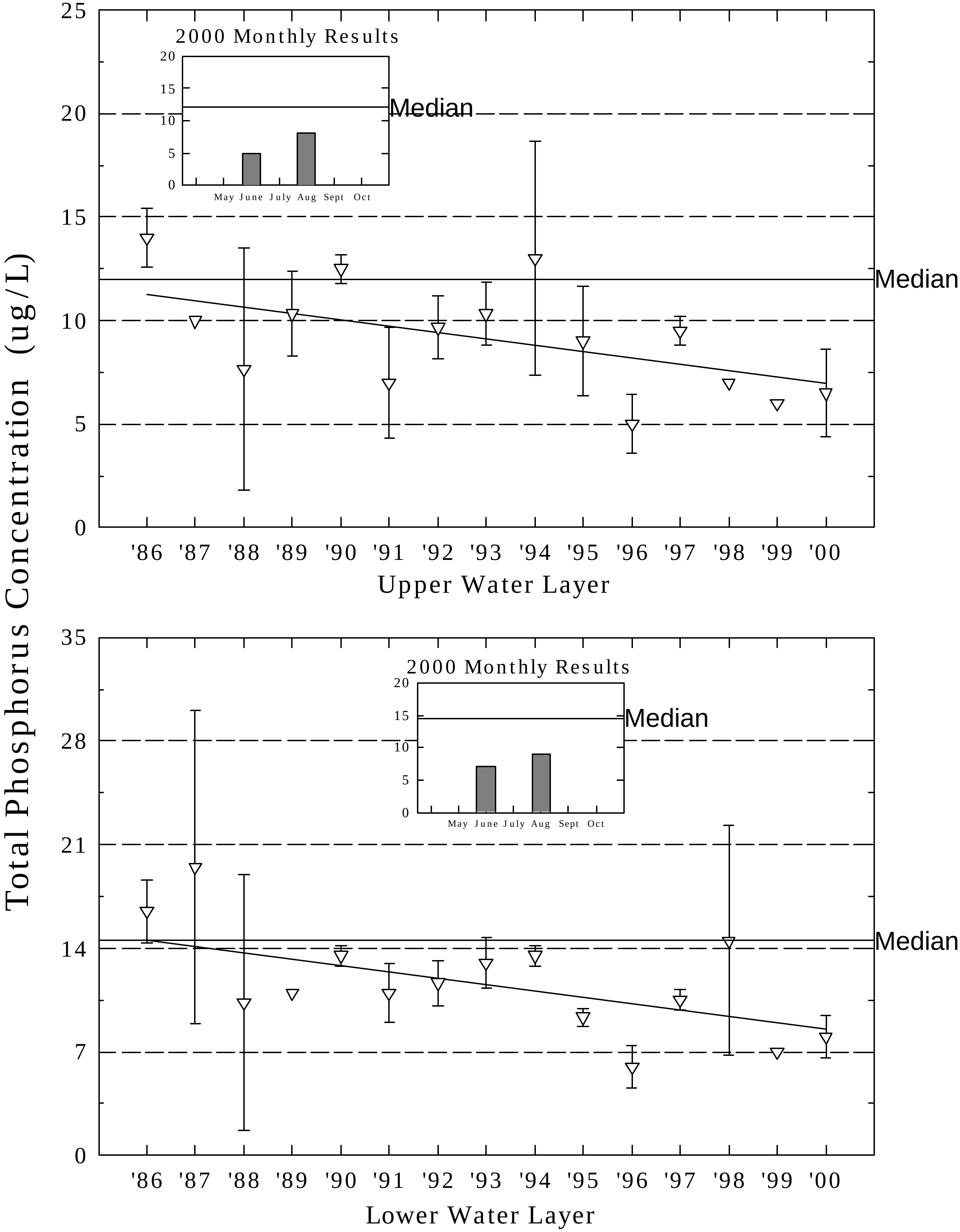


Table 1.

ROCK POND

WINDHAM

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1986	2.25	5.66	3.95
1987	5.14	9.78	7.46
1988	2.82	5.15	4.13
1989	2.35	4.34	3.08
1990	3.28	5.41	4.29
1991	4.20	11.17	8.19
1992	4.19	6.78	5.36
1993	2.56	2.92	2.73
1994	3.08	4.19	3.63
1995	2.91	3.32	3.16
1996	4.13	4.61	4.37
1997	3.11	5.33	4.22
1998	3.65	12.42	8.03
1999	3.13	3.13	3.13
2000	7.14	7.75	7.44

Table 2.

ROCK POND

WINDHAM

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08 / 14 / 1986	CHRYSOSPHAERELLA	62
06 / 17 / 1987	ASTERIONELLA	35
	CERATIUM	30
	CHRYSOSPHAERELLA	26
08 / 18 / 1987	CERATIUM	42
	DINOBRYON	39
06 / 15 / 1988	CERATIUM	56
	DINOBRYON	21
06 / 27 / 1989	DINOBRYON	80
	ASTERIONELLA	
08 / 06 / 1990	DINOBRYON	50
	CERATIUM	22
08 / 02 / 1991	CERATIUM	50
	CHRYSOSPHAERELLA	20
	DINOBRYON	20
07 / 08 / 1992	DINOBRYON	45
	ASTERIONELLA	37
	CERATIUM	4
09 / 01 / 1993	ASTERIONELLA	33
	CERATIUM	30
08 / 08 / 1994	CERATIUM	83
07 / 28 / 1995	DINOBRYON	76
	CERATIUM	13
	ASTERIONELLA	8

Table 2.

ROCK POND

WINDHAM

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08 / 20 / 1996	CERATIUM	75
	ASTERIONELLA	17
	CHRYSOSPHAERELLA	3
08 / 27 / 1998	CERATIUM	64
	DINOBRYON	32
	SYNURA	2
07 / 30 / 1999	DINOBRYON	45
	MICROCYSTIS	24
	CERATIUM	23
08 / 09 / 2000	DINOBRYON	37
	CERATIUM	34
	CHRYSOSPHAERELLA	16

Table 3.

ROCK POND

WINDHAM

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1986	3.9	4.5	4.2
1987	4.3	4.5	4.4
1988	3.7	4.6	4.2
1989	4.5	5.8	5.0
1990	4.0	5.5	4.7
1991	3.1	4.4	3.8
1992	4.0	5.5	4.5
1993	4.7	4.8	4.7
1994	4.7	4.7	4.7
1995	4.7	6.3	5.2
1996	4.8	5.3	5.0
1997	4.5	4.8	4.6
1998	5.4	5.4	5.4
1999	4.5	4.5	4.5
2000	3.8	3.8	3.8

Table 4.

ROCK POND
WINDHAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1986	7.20	7.36	7.27
	1987	7.02	7.13	7.07
	1988	6.39	7.10	6.77
	1989	6.79	7.48	7.09
	1990	7.19	7.36	7.30
	1991	7.10	7.40	7.21
	1992	7.07	7.22	7.13
	1993	7.22	7.32	7.26
	1994	7.24	7.25	7.25
	1995	7.21	7.39	7.30
	1996	6.76	7.20	6.93
	1997	7.08	7.13	7.10
	1998	7.12	7.21	7.16
	1999	6.91	6.91	6.91
	2000	7.12	7.19	7.15
HYPOLIMNION				
	1986	6.67	7.37	6.89
	1987	6.41	6.56	6.48
	1988	6.33	6.85	6.63
	1989	6.79	6.98	6.86
	1990	6.65	7.06	6.82
	1991	6.77	6.80	6.79
	1992	6.74	6.97	6.81
	1993	6.74	6.94	6.83
	1994	6.60	6.71	6.65

Table 4.

ROCK POND
WINDHAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1995	6.77	7.30	6.89
	1996	6.58	6.70	6.64
	1997	6.88	7.14	6.99
	1998	6.39	7.09	6.61
	1999	6.84	6.84	6.84
	2000	6.46	6.59	6.52
INLET				
	1986	5.79	6.05	5.90
	1987	6.61	6.61	6.61
	1988	5.82	6.72	6.18
	1989	5.85	7.23	6.37
	1990	6.48	6.64	6.55
	1991	6.71	7.00	6.83
	1992	6.70	6.97	6.81
	1993	6.63	6.63	6.63
	1994	6.90	6.90	6.90
	1995	6.74	6.74	6.74
	1997	6.91	6.91	6.91
	2000	6.72	6.98	6.83
IVERS BROOK				
	1992	6.55	6.55	6.55
METALIMNION				
	1987	6.84	6.84	6.84

Table 4.

ROCK POND
WINDHAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
OUTLET				
	1986	7.08	7.33	7.19
	1987	6.86	6.86	6.86
	1988	6.78	7.08	6.88
	1989	7.02	7.12	7.07
	1990	6.61	7.55	6.94
	1991	6.61	7.40	6.94
	1992	7.02	7.14	7.06
	1993	7.28	7.37	7.32
	1994	7.05	7.33	7.17
	1995	7.07	7.07	7.07
	1996	6.89	6.89	6.89
	1997	6.89	7.09	6.98
	1998	6.99	7.12	7.05
	2000	6.97	6.97	6.97

Table 5.

ROCK POND

WINDHAM

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1986	8.27	9.50	8.89
1987	8.20	9.80	9.00
1988	9.70	11.30	10.15
1989	10.10	13.80	11.28
1990	12.30	18.00	14.47
1991	11.30	23.30	15.60
1992	11.00	13.80	12.43
1993	11.10	13.30	12.37
1994	11.30	11.80	11.55
1995	10.90	11.70	11.37
1996	10.50	19.80	15.15
1997	9.40	9.60	9.50
1998	11.40	12.00	11.70
1999	12.10	12.10	12.10
2000	11.70	13.00	12.35

Table 6.

ROCK POND
WINDHAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1986	91.9	91.9	91.9
	1987	85.1	89.3	87.2
	1988	94.8	100.5	98.6
	1989	101.1	105.0	102.6
	1990	104.7	107.4	106.4
	1991	101.4	104.8	102.9
	1992	98.9	101.5	100.2
	1993	102.9	106.3	104.9
	1994	108.2	110.6	109.4
	1995	100.8	107.3	103.6
	1996	97.7	100.6	99.1
	1997	94.2	99.8	97.0
	1998	95.2	95.9	95.5
	1999	121.9	121.9	121.9
	2000	105.5	106.3	105.9
HYPOLIMNION				
	1986	91.9	91.9	91.9
	1987	79.9	80.0	79.9
	1988	95.2	104.6	99.6
	1989	101.1	104.8	102.8
	1990	94.7	101.4	98.8
	1991	96.8	100.3	98.9
	1992	95.7	102.6	98.8
	1993	99.8	105.1	102.8
	1994	104.7	107.5	106.1

Table 6.

ROCK POND
WINDHAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1995	99.5	107.5	102.4
	1996	97.3	97.7	97.5
	1997	91.6	94.1	92.8
	1998	94.9	96.4	95.6
	1999	120.4	120.4	120.4
	2000	111.8	111.8	111.8
INLET				
	1986	94.9	94.9	94.9
	1987	87.6	87.6	87.6
	1988	97.6	170.8	129.3
	1989	101.8	110.6	104.5
	1990	109.2	109.6	109.4
	1991	98.9	104.8	101.8
	1992	93.5	102.1	97.8
	1993	104.6	104.6	104.6
	1994	110.5	110.5	110.5
	1995	102.2	102.2	102.2
	1997	92.7	92.7	92.7
	2000	105.5	106.4	105.9
IVERS BROOK				
	1992	67.6	67.6	67.6
METALIMNION				
	1987	83.9	83.9	83.9
OUTLET				
	1986	91.9	91.9	91.9
	1987	87.1	87.1	87.1

Table 6.

ROCK POND
WINDHAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1988	99.2	115.6	106.5
	1989	49.4	104.0	84.2
	1990	107.3	128.6	114.9
	1991	100.1	104.4	102.6
	1992	99.3	102.0	100.7
	1993	102.7	105.1	103.9
	1994	109.1	110.8	109.9
	1995	102.5	102.5	102.5
	1996	97.4	97.4	97.4
	1997	97.7	171.5	134.6
	1998	88.3	96.6	92.4
	2000	105.7	105.7	105.7

Table 8.

ROCK POND
WINDHAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1986	13	15	14
	1987	10	10	10
	1988	< 1	12	6
	1989	7	12	9
	1990	12	13	12
	1991	4	9	7
	1992	8	11	9
	1993	9	12	10
	1994	9	17	13
	1995	6	11	9
	1996	4	6	5
	1997	9	10	9
	1998	7	7	7
	1999	6	6	6
	2000	5	8	6
FROIOS AT JORDAN RD				
	1993	42	42	42
	1994	5	5	5
FROIOS AT POND				
	1993	3000	3000	3000
HYPOLIMNION				
	1986	15	18	16
	1987	12	27	19
	1988	< 1	18	8

Table 8.

ROCK POND
WINDHAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1989	11	11	11
	1990	13	14	13
	1991	9	13	11
	1992	10	13	11
	1993	11	14	13
	1994	13	14	13
	1995	9	10	9
	1996	5	7	6
	1997	10	11	10
	1998	9	20	14
	1999	7	7	7
	2000	7	9	8
INLET				
	1986	13	100	56
	1987	18	18	18
	1988	2	46	24
	1989	9	30	19
	1990	37	67	52
	1991	12	14	13
	1992	12	22	17
	1993	38	38	38
	1994	16	16	16
	1995	27	27	27
	1997	135	135	135
	2000	6	8	7

Table 8.

ROCK POND
WINDHAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
IVERS BROOK				
	1992	9	9	9
	1993	78	78	78
	1994	3	3	3
METALIMNION				
	1987	17	17	17
OUTLET				
	1986	10	28	19
	1987	11	11	11
	1988	1	27	11
	1989	5	9	7
	1990	9	61	28
	1991	4	9	7
	1992	9	11	10
	1993	7	8	7
	1994	15	22	18
	1995	6	6	6
	1996	4	4	4
	1997	9	9	9
	1998	5	9	7
	2000	< 5	5	5
STONEWALL IVERS BK				
	1993	32	32	32
WETLAND CUL DE SAC				
	1986	1140	1140	1140

Table 8.

ROCK POND

WINDHAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
WETLAND DISCHARGE				
	1986	682	682	682

Table 9.

ROCK POND
WINDHAM

Current year dissolved oxygen and temperature data.

Depth (meters)	**Temperature** (celsius)	**Dissolved Oxygen** (mg/L)	**Saturation** (%)
August 9, 2000			
0.1	24.9	7.9	95.2
1.0	24.9	7.7	92.8
2.0	24.5	7.8	92.9
3.0	23.1	7.9	91.8
4.0	21.4	3.2	36.0
5.0	17.0	1.6	16.5
6.0	12.6	0.2	2.1
7.0	10.7	0.3	2.4

Table 10.

ROCK POND
WINDHAM

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 19, 1986	6.0	13.0	7.9	73.0
June 17, 1987	8.0	8.0	5.5	46.0
August 18, 1987	7.5	10.0	0.3	3.0
February 24, 1988	7.0	4.0	8.4	63.0
June 15, 1988	8.0	8.0	1.2	10.0
June 27, 1989	8.0	8.0	3.5	29.0
August 2, 1991	7.5	10.0	0.0	0.0
July 8, 1992	7.5	10.1	0.3	2.7
September 1, 1993	7.0	10.9	0.8	7.0
August 8, 1994	7.0	10.1	0.9	8.0
July 28, 1995	7.0	10.8	0.2	2.0
August 20, 1996	7.0	13.1	0.3	3.0
August 8, 1997	7.0	11.2	0.7	6.0
August 27, 1998	7.0	9.6	0.3	3.0
July 30, 1999	7.0	15.5	5.5	55.5
August 9, 2000	7.0	10.7	0.3	2.4

Table 11.

ROCK POND
WINDHAM

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1997	0.4	0.4	0.4
	1998	0.4	0.5	0.5
	1999	0.3	0.3	0.3
	2000	0.3	0.4	0.3
HYPOLIMNION				
	1997	0.3	0.4	0.4
	1998	0.6	1.3	0.9
	1999	0.5	0.5	0.5
	2000	0.5	0.5	0.5
INLET				
	1997	59.0	59.0	59.0
	2000	0.4	1.0	0.7
IVERS BROOK				
	1993	6.8	6.8	6.8
OUTLET				
	1997	0.4	0.5	0.4
	1998	0.4	1.3	0.9
	2000	0.3	0.3	0.3